Correlations Between Fruit and Vegetable Consumption and Socioeconomic Factors Among Patients with Chronic Venous Leg Ulcers

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Abstract

This study's purpose was to measure fruit and vegetable intake and its potential correlation to social economic status (SES) (annual income and education level) in a sample of older adults with chronic wounds. The antioxidants, vitamins A, C, E, and zinc contained in fruits and vegetables are essential for efficient wound healing (lower levels are linked to slower healing) and optimal health. Chronic wound prevalence has increased dramatically in the U.S. with associated costs now at ~$3 billion/year, but little is known about fruit and vegetable consumption by chronic wound patients. This descriptive correlational study utilized data from a larger project to measure fruit and vegetable servings/d by chronic wound patients (n=37) who completed electronic food frequency questionnaires validated in the Women's Health Initiative, and sociodemographic questionnaires. Body mass index (BMI) was also calculated. Correlations between fruit and vegetable servings and SES were assessed using Spearman's rho. On average, study participants consumed 1.18 servings/d of fruit (SD=1.35) and 0.93 servings/d of vegetables (SD = 0.82) – (Dietary Guidelines for Americans: 2 servings/d of fruit; 2.5 servings/d of vegetables). On average, the group was 61.5 years (SD=11.5) with a BMI of 40.6 (SD=11.48). The majority were male (65%), white (73%), and unemployed/disabled (87%). Although 92% reported having ≥ a high school diploma, 63% reported making ≤ $29,000/year. This study reports that chronic wound patients in the sample were consuming inadequate amounts of fruits and vegetables (per national guidelines) and were severely obese. Although no significant link between fruit and vegetable intake and SES emerged, collective findings suggest that assessing fruit and vegetable intake, determining potential barriers to consuming adequate amounts, and developing patient-centered interventions to promote consumption and reduce high BMIs may

improve healing outcomes. Interdisciplinary teams of nurses and dieticians could lead these initiatives and design future studies with larger samples.

Chapter I: Statement of the Problem

Introduction

Most Americans are not consuming the recommended daily servings of fruits and vegetables according to the Dietary Guidelines for Americans (2010). This is becoming a significant issue in terms of wound healing because adequate nutrition is essential for tissue regeneration. Further, poor nutritional intake is associated with comorbidities such as diabetes and cardiovascular disease that increase the risk of healing delays. The nutrients found abundantly in fruits and vegetables are essential for normal cellular functioning and when consumed in lower than recommended amounts, can reduce the actions of cells involved in reparative processes (McKay & Miller, 2003). Thus consuming an adequate amount of fruits and vegetables on a daily basis is very important for patients with chronic wounds whose skin integrity has been compromised. This is especially true for older adults who often have diminished immune system function and nutritional deficiencies because of poor dentition, depression and/or a limited income (Gould et al, 2015). Therefore this study focused on evaluating fruit and vegetable consumption by older adults with one of the three major types of chronic wounds, chronic venous leg ulcers (CVLUs), because 1) CVLUs are associated with aging, 2) the incidence of CVLUs is increasing dramatically, and 3) dietary intake patterns of older adults with CVLUs have not been studied.

Background

"Eat your fruits and vegetables." It is a recommendation that you have probably heard over and over since childhood, but may not have followed on a daily basis because you were not aware of the strong link between fruits and vegetables and health – and you are not alone. Many

people are not eating the daily number of fruit and vegetable servings recommended in the Dietary Guidelines for Americans (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). However, there is growing body of evidence that the nutrients contained in fruits and vegetables help prevent disease and enhance overall health (McKay & Miller, 2003). For example, consuming adequate amounts of fruits and vegetables has been correlated with a reduced risk of cardiovascular disease and some cancers (Alissa & Ferns, 2015; Busch et al., 2015; Gibson et al., 2012.). According to the American Journal of Clinical Nutrition, "Several of the micronutrients associated with diets high in fruits and vegetables, such as carotenoids, flavonoids, and vitamin C, have been shown to help immune function" (Gibson et al., 2012, p. 1429), which ultimately impacts many physiological processes such as wound healing.

Wound healing involves a complex series of events and interactions between several different types of immune cells such as neutrophils and monocytes (McKay & Miller, 2003). It also requires that adequate amounts of oxygen and nutrients reach the site of damage. Thus the nutritional status of an individual can affect the length of time it takes a wound to heal and the integrity of the healed tissue.

Several nutrients found abundantly in fruits and vegetables are essential to the wound healing process. For instance, vitamin A is required for epithelial regeneration, cellular differentiation and effective immune system function (McKay & Miller, 2003). Vitamin C (ascorbic acid) is an essential cofactor for the synthesis of collagen and proteoglycans, which strengthen tissues and other organic components of the intracellular matrix of skin, bone, capillary walls and other connective tissues. Vitamin C also enhances neutrophil function, increases angiogenesis and functions as a powerful antioxidant (McKay & Miller, 2003).

Vitamin E helps to stabilize cell membranes and serves as a powerful antioxidant. Zinc is important for enzyme activity, DNA synthesis, cell division and protein synthesis. (McKay & Miller, 2003). Although these key nutrients important for efficient wound healing are abundantly found in multiple fruits and vegetables, little is known about fruit and vegetable consumption in the wound population. Additionally, certain groups of people, such as older adults who are at increased risk for immune system dysfunction and chronic wounds (e.g., CVLUs), may benefit significantly from consuming the recommended daily servings (or more) of fruits and vegetables. However, more evidence is needed to support or negate this hypothesis before new recommendations can be incorporated into evidence-based practice guidelines.

Purpose

This study's purpose was to compare daily servings of fruits and vegetables consumed by a sample of patients with CVLUs to the national recommendations and explore potential barriers involving socioeconomic status (SES) that may be preventing adequate consumption.

Study Aims

In a sample of older adults with CVLUs:

Aim 1: Measure daily servings of fruit and vegetable consumed by the sample and compare to recommendations by the Dietary Guidelines for Americans, 2010.

Aim 2: Determine strength of correlation between daily servings of fruits and vegetables and SES as measured by annual income and educational level.

Aim 3: Assess anthropometric measures to determine strength of correlation between body mass index and number of daily servings of fruits and vegetables.

Significance

Chronic venous leg ulcers are serious wounds that develop in the lower extremities and cause significant morbidity and a reduced quality of life. They affect approximately 1% of the United States (U.S.) population and 3.6% of people over the age of 65 years. (Moor, Vachon, & Gould, 2009; Collins & Seraj, 2010). Annual treatment-related costs are currently estimated to be greater than $3 billion in the U.S. alone (Valencia, Falabella, Kirsner, & Eaglstein, 2001), which is expected to rise dramatically in tandem with the incidence of CVLUs, conditions associated with aging.

Venous leg ulcers lead to significant emotional and economic hardships for patients and their families because these wounds are so challenging to treat and often recur. Additionally, patients with CVLUs often have other comorbidities that negatively impact healing such as diabetes and cardiovascular disease that are exacerbated by poor dietary choices. Although research has consistently shown that adequate nutritional intake is essential for normal wound healing, nutritional assessments are not included in usual care planning for patients with CVLUs (or other types of chronic wounds). Dietary interventions based on nutritional assessments of patients with CVLUs may facilitate healing.

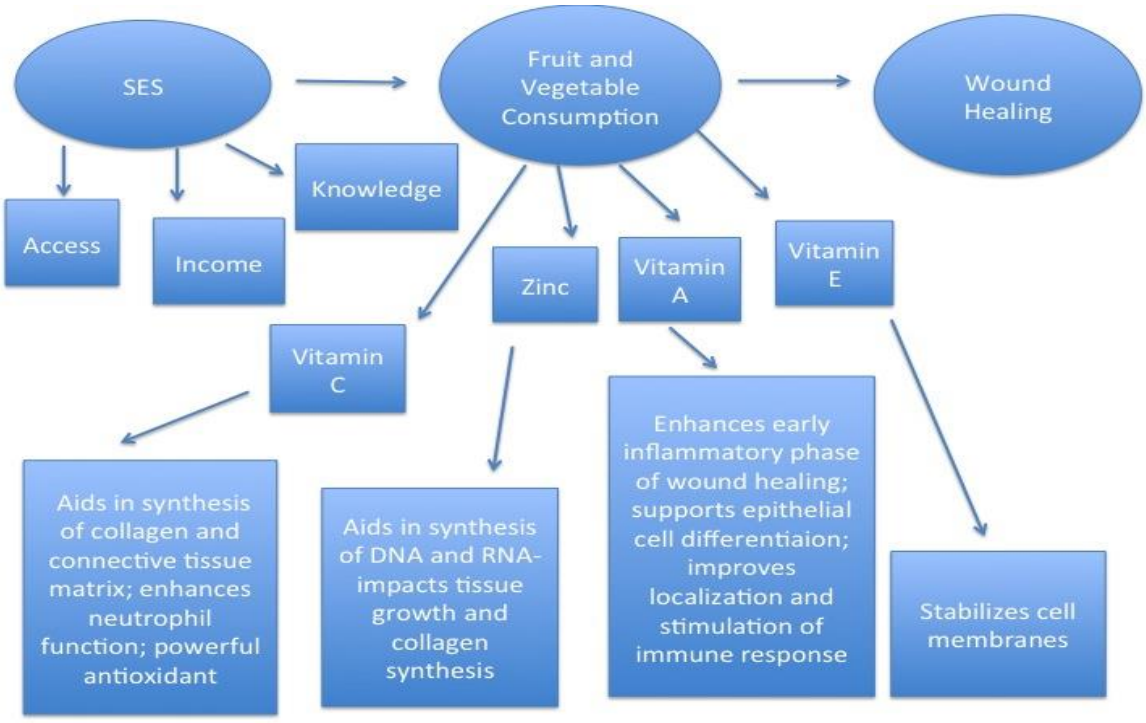
Theoretical Framework

The theoretical framework used to guide the choice of study variables is based on the Social Ecological Theory (Bronfenbrenner, 1977), which posits that the social-ecological environment influences behavior. (Figure 1) This theory describes a multifactorial system that influences behavior (i.e. choosing to purchase and consume fruits and vegetables). In this model SES is comprised of income, education level and environmental factors determined by one's residence. Based on this theory, it can be hypothesized that if a person has a higher SES (higher level of education) they are more likely to understand the importance of fruit and vegetable

consumption and thus will likely have higher intake levels than a person with a lower level of education. Additionally, persons with a higher SES (living in safe, affluent neighborhoods) may have greater access to restaurants and supermarkets that provide a wide array of fresh produce options than people with a lower SES. Finally, people with a higher SES (higher income) will be more likely to purchase nutrient dense foods such as fruits and vegetables than people with a lower income.

Figure 1

Theoretical Framework



Chapter II: Literature Review

Chronic venous leg ulcers are serious conditions that affect millions of people in the U.S. and more commonly occur in the older adult population (Gould et al., 2015). CVLUs usually occur over bony prominences and are generally irregular and shallow. Possible risk factors include old age, obesity, previous leg injury, deep vein thrombosis, and phlebitis (Nelson & Bell-Syer, 2014). Venous leg ulcers often recur and open ulcers can last months to years. The collective complications can lead to significant financial burdens for the patient, family and healthcare system because of the high cost of treatments and recurring visits to healthcare providers.

Nutrition plays a key role in the healing of damaged tissues and several nutrients found abundantly in fruits and vegetables are particularly important for efficient wound healing. Several studies have explored how fruit and vegetable consumption can help prevent many diseases including cardiovascular disease and diabetes, and improve overall health, (Macready et al., 2014; Leenders et al., 2015; Bauer et al., 2013), few studies have focused on the nutritional patterns of patients with chronic wounds, and in particular, patients with chronic wounds such as CVLUs that are rising in prevalence because of their link to aging. Furthermore, it is not known if older adults with CVLUs are encountering socioeconomic barriers to purchasing and/or eating these nutrient dense foods.

Fruits and vegetables and cardiovascular disease/Cancer

Several epidemiologic studies have shown that fruits and vegetables are cardioprotective. For example, a study by Macready et al. (2014) evaluated flavonoid rich fruits and vegetables and the relation to the inflammatory state of microvasculature. The study reported that men who consumed higher levels of flavonoid rich fruits and vegetables had a significant reduction in C-

reactive protein (CRP), E-selectin and vascular cell adhesion molecules (Macready et al., 2014). The data in this study support the need for increasing flavonoid rich fruits and vegetables in the diet, specifically for men who are at higher risk for cardiovascular disease (Macready et al., 2014). Additionally, a study titled CARDIA (Coronary Artery Risk Development in Young Adults) examined the relationship between diet and coronary artery calcium scores (Lictenstein, A.H, 2015). The study found an inverse relationship between fruit and vegetable intake in young adulthood and the prevalence of coronary artery calcium later in life. This association was only detected in women although the studied examined men and women aged 18-30. The study was performed over a 20-year period using the CARDIA diet history (Lictenstein, A. H, 2015).

Fruits and vegetables may also protect against certain cancers. A meta-analysis of studies comparing high and low intakes of fruits and vegetables to lung cancer incidence and mortality, found an 8-18% decreased risk of lung cancer by increasing fruit and vegetable consumption (Vieira et al., 2015). Likewise, an inverse association between colon cancer and fruit and vegetable intake has been reported. In a medical record review study performed by Leenders et al., (2015), various types of fruits and vegetables in varying amounts were studied in relation to colon and colorectal cancer. The study found that a lower risk of colon cancer was observed with a higher consumption of fruits and vegetables; there was no association with rectal cancer (Leenders et. Al, 2015).

Other studies have examined the Mediterranean diet (which is rich in fruits and vegetables) in relation to cancer. For example, a study by Turati, Rossi, Pelucchi, Levi, and Vecchia (2015) found that a high intake of fruit was correlated with decreased risk of several cancers particularly in the digestive tract. Similarly, a high vegetable intake was associated with decreased risk of epithelial cancers including pharyngeal, oral, liver, pancreatic and stomach.

Additionally, endometrial and ovarian cancers were inversely related to vegetable consumption. (Turati et al., 2015). However these studies have some limitations. For example, it was not determined if the specific nutrients themselves or the fiber and flavonoid contents were responsible for the outcomes. Thus additional research is needed to determine more specifically how fruits and vegetables reduce cardiovascular and cancer risk.

Fruit and vegetables and socioeconomic status

Studies have suggested that the number of fruits and vegetables one consumes each day is reflective of SES (Darmon & Drewnowski, 2008). In a cross sectional study of a nationally representative cohort pulled from a population-based European Prospective Investigation in Cancer (EPIC) study in Norfolk, UK who responded to a mailed health and life experiences questionnaire and food frequency questionnaire, it was found that the variety of fruits and vegetables consumed more so than the quantity of fruits and vegetables varied across SES (determined by annual income, occupational grade, education and wealth)(Conklin, Forouhi, Suhrcke, Surtees, Wareham & Monsivais, 2014). Another study done in 30 different provinces of Iran evaluated SES, age, gender and fruit and vegetable consumption and found that in general, a higher SES was correlated with higher fruit and vegetable consumption. Additionally, females were more likely than males to consume more fruits and vegetables and older adults across all SES were found to consume less fruits and vegetables (Kiadaliri, 2014).

In a study performed among children aged 2-11 in California, data suggested that multiple racial and ethnic differences in dietary practices existed. For example, increased fruit and vegetable consumption was associated with parent education but not income (Guerrero & Chung, 2015). In another study performed in Brazil, neighborhood factors were examined to determine SES and the relationship to fruit and vegetable consumption (Pessoa, Mendes, Gomes,

Martins &Valasquez-Melendez, 2015). The data revealed that neighborhoods with a higher density of healthy food stores and restaurants and higher income were more likely to consume more fruits and vegetables. The study suggests that differences in health disparities exist in neighborhoods with different socioeconomic levels (Pessoa et al., 2015).

More evidence that a higher prevalence of healthy options in metropolitan areas impacts the rates of diabetes, obesity and intake levels of fruits and vegetables comes from a study performed in 2015 (Frankenfeld, Leslie & Makara, 2015). In this study a measure of healthy food options was measured based on the ratio of number of sources of unhealthy food options to healthy options. The results of the study suggest that the immediate food environment (i.e. the number of grocery stores and restaurants) is inversely associated with prevalence of diabetes, obesity and 5+ fruit and vegetable/day consumption in the metropolitan Washington D.C area. (Frankenfeld, Leslie & Makara, 2015).

Wounds and Nutrition

Some studies have evaluated the effects of nutritional supplementation on chronic wound healing, but the findings have been conflicting. For example, a study performed in Australia, assessed two groups of patients with chronic wounds; one group was given a nutritional supplement containing arginine, vitamin C and zinc (defined as a wound specific supplement) and the other group received a standard high protein, high energy supplement (Bauer, Isenring, & Waterhouse, 2013). Results showed that the standard high protein supplement group had significantly greater wound healing when compared with the group consuming the wound specific supplement (Bauer, Isenring, & Waterhouse, 2013). A more recent study examined the effects of a high protein supplement enriched with arginine, zinc and antioxidants on healing in a group of malnourished older adults with stage II, III and IV pressure ulcers in long term care

facilities (Ceereda, et al., 2015). This study reported that the group consuming the supplement enriched with arginine, zinc and antioxidants had a greater reduction in pressure ulcer size (mean reduction 60.9%) than the control group who received only a high calorie, high protein formula. Thus the data suggested that targeted nutritional supplementation could facilitate wound healing in malnourished patients with pressure ulcers (Ceereda, et al. 2015).

Similar to the study by Ceereda et al. (2015) is one by Desneves, Todorovic, Cassar and Crowe (2005) that assessed the effects of adding arginine, vitamin C and zinc to standard hospital diets in patients with stage two, three or four pressure ulcers. After three weeks of supplementation there were significantly high rates of healing for the treatment group compared to the control group who received a standard hospital diet. Furthermore, in a study by Van Anholt et al. (2010), a group consuming a protein supplement containing arginine, vitamin C and zinc showed significantly more healing of pressure ulcers when compared to the control group. The collective findings from multiple studies suggest the importance of certain nutrients to the wound healing process in cohorts of patients with chronic wounds.

Current Recommendations for Fruit and Vegetable Consumption by Older Adults

The U.S. Department of Health and Human Services and U.S. Department of Agriculture developed the Dietary Guidelines for Americans (2010) based on research examining the impact of certain food groups, including fruits and vegetables, on general health. As a result of the collective findings the guidelines recommend consuming a specific number of fruit and vegetable servings each day based on age and gender, and choosing a variety of fruits and vegetables. The current recommendations are that 1) older adult males (51+ years) consume at least 2 cups of fruit and 2.5 cups of vegetables per day, and 2) older adult females (51+ years) to consume at least 1.5 cups of fruit and 2 cups of vegetables per day.

Chapter III: Methodology

Research Design

The current study used a descriptive correlational design and data generated from a randomized clinical trial completed in 2014 (that examined the effects of an omega-3 fatty acid supplement on CVLU healing) to achieve the specific aims.

Population Sample

Data from 41 participants were collected in the parent study. Complete data from 37 men and women who had at least one existing CVLU for ≥ 3 months (ages 18-85 years) were included for analysis in the current study.

Setting

The parent study was completed at the Clinical Research Center (CRC) at The Ohio State University and conducted in compliance with recognized international standards and the principles of the Declaration of Helsinki.

Instruments

Food frequency questionnaire

The parent study used a Food Frequency Questionnaire? (FFQ) (VioFFQ, Viocare, Inc, Princeton, NJ) validated by the Women's Health Initiative (Patterson et al., 1999). This is a web-based system that allows participants to self-administer the questionnaire via a tablet connected to Internet. Prior to taking the survey, study participants received 5-minute audio and visual instructions over taking the survey. They were told that the survey would take approximately 30 minutes and it would ask them questions about the type, frequency and quantity of foods and beverages consumed in the previous 90 days. The research nurse or PI was available for questions while participants completed the questionnaire. Once completed, the FFQ

generates data about macro and micronutrients and food patterning (e.g. daily servings of fruits and vegetables).

Sociodemographic questionnaire

Participants completed a self-report sociodemographic survey that included questions about gender, age, income level ($0 to 4,999; $5,000 to 9,999; $10,000 to 14,999; $15,000 to 19,999; $20,000 to 24,999; $25,000 to 29,999; $30,000 to 34,999; $35,000 to 39,999; $40,000 to 44,999; and $45,000 and up), years of education (some high school, high school, some college, college or university graduate [Bachelors or equivalent], and graduate or professional training [Masters, JD, MD, PhD, etc.]), marital status, race/ethnicity, occupation/employment, perceived stress and nutritional supplement use.

Anthropometric measures

Height, weight and BMI were calculated by the CRC nurses. Height was measured using the Harpendon Stadiometer (Holtain Limited, Crymych, Dyfed, U.K.) to the nearest 0.1 cm. Body weight was measured using the ProPlus Scale (Healthometer Bridgeview Illinois) to the neasrest 0.1 kg. BMI was calculated as body weight (kg) divided by height (m) squared. This information was classified using the National Institute of Health's obesity classification scale.

Data Analysis

Descriptive statistics (percentages, means, and standard deviations [SD]) were used to characterize the average number of daily fruit and vegetable servings consumed by the group , the average annual income and educational levels, and the average BMI. The Spearman's rho statistic was used to determine correlations between SES, BMI and daily fruit and vegetable servings. A probability of less than .05 was considered statistically significant.
SPSS version 22 was used to conduct the analyses.

Chapter IV: Research Results

Participant Characteristics

This secondary analysis compiled data from 37 men and women aged 28-81 years old from Central Ohio with a history of CVLU for ≥ 3 months. The majority (81%) was older adult, Caucasian males (M= 61.5 yrs., SD=11.5) and unemployed or disabled (87%). (Table 1) Although 92% reported ≥ a high school education, 63% reported earning ≤ $29,000/year.

Table 1. Sociodemographic data (n=37)

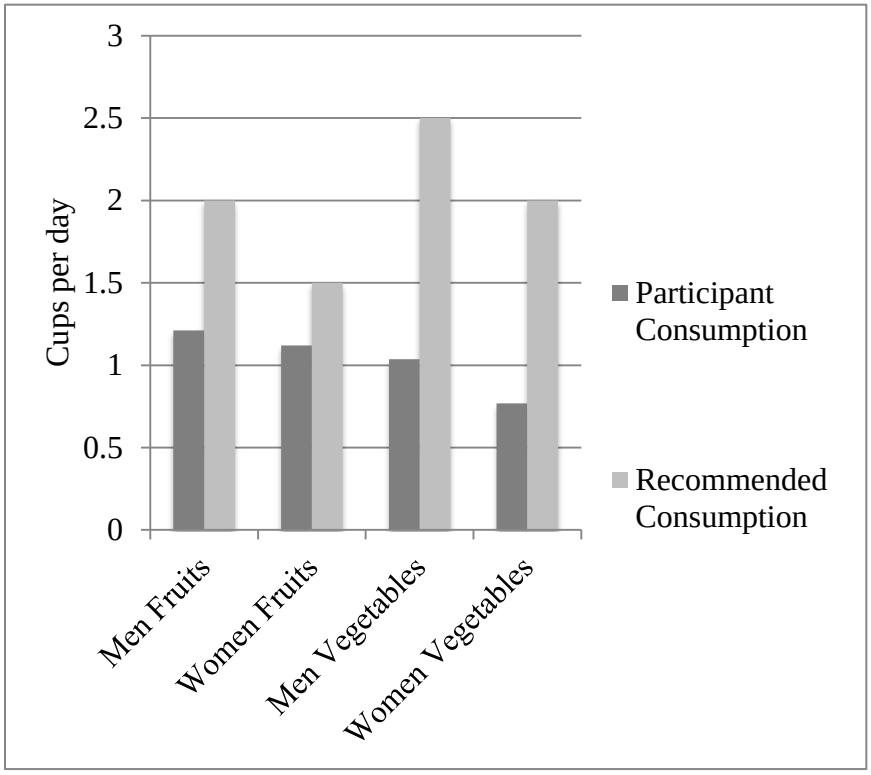
	Number in sample (SD)
Age, mean years	61.5 (11.5)
Age, range	28-81
Gender:	
Male	24
Female	13
Race:	
Caucasian	27
African American	10
Education:	
Some high school/ High school graduate	13
Some college	13
College/University graduate	9
Annual household income:	
< $10.000	9
$10,000 - $14,999	8
$15,000 - $29,999	6
$30,000 - $44,999	3
$45,000 or more	11
Employment:	
Disabled	8
Working	5
Not employed	24
Marital Status:	
Married/living with partner	18
Divorced	9
Single	6
Widowed	3

Mean (SD) all such values

On average, participants consumed less than the recommended daily servings of fruit (M= 1.18,SD=1.35)and vegetables (M=0.93, SD = 0.82) – National guidelines recommend 2 cups/d of fruit and 2.5 cups/d of vegetables for males 50+ years and 1.5 cups/d of fruit and 2 cups/d of vegetables for females 50+ years.

Figure 2.

Fruit and vegetable servings/day by gender compared to national recommendations (n=37)



There were no statistically significant correlations between fruit and vegetable intake and SES at the 0.05 level (education and fruit [0.426], income and fruit [0.880], education and vegetable [0.963], income and vegetable [0.509]).

Table 2.

Correlation Table (n=37)

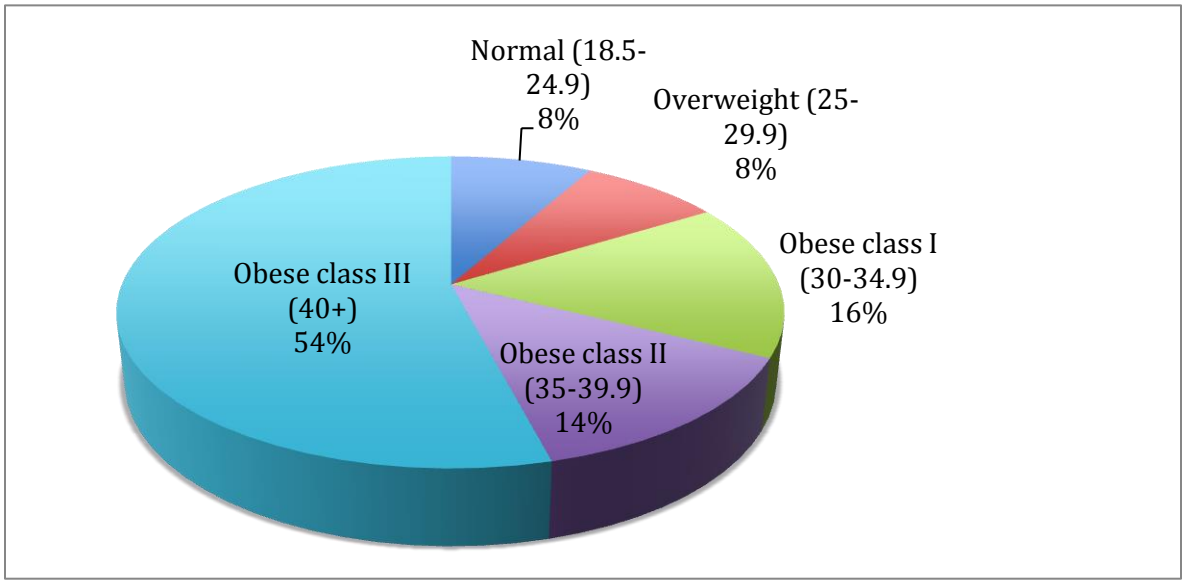
			Fruit	Vegetable	Education	Income
Spearman's rho	Fruit	Correlation Coefficient	1.000	.420**	-.135	.026
		Sig. (2-tailed)	.	.010	.426	.880
		N	37	37	37	37
	Vegetable	Correlation Coefficient	.420**	1.000	-.008	-.112
		Sig. (2-tailed)	.010	.	.963	.509
		N	37	37	37	37
	Education	Correlation Coefficient	-.135	-.008	1.000	.207
		Sig. (2-tailed)	.426	.963	.	.218
		N	37	37	37	37
	Income	Correlation Coefficient	.026	-.112	.207	1.000
		Sig. (2-tailed)	.880	.509	.218	.
		N	37	37	37	37

** Correlation is significant at the 0.01 level (2-tailed).

The average BMI for the study sample was 40.6 (SD=11.48) indicating obesity class III, and the majority (92%) was categorized as overweight or obese (classes I, II and III). (Figure 3)

Figure 3.

BMI Classifications of Participants (N=37)



BMI classifications according to the National Heart, Blood and Lung Institute, (2012)

Chapter V: Conclusions/ Implications

The purpose of this study was to measure daily intake levels of fruits and vegetables in a sample of CVLU patients, compare them to the recommendations by the Dietary Guidelines for Americans (2010), and assess the strength of correlation between daily intake levels, SES and BMI. Although no significant correlation between the number of fruit and vegetable servings consumed each day and annual income or education level was detected in the current study, the data show that the majority of the sample (87%) was consuming well below the recommended daily servings according to the national guidelines (Dietary Guidelines for American, 2010). Further, greater than 50% of the sample reported income levels of < $16,000 per year, which is the poverty line for households < 65 years of age. Previous studies by others have suggested that income is likely a factor in whether people consume fruits and vegetables on a daily basis (Darmon & Drewnoski, 2008). Thus a relatively low annual income may have been a barrier to consuming adequate amounts of fruits and vegetables for some people in the sample, but because of the small sample size the association between intake levels and SES was not statistically significant.

The study data also show that the majority of the sample was obese (84%), however there was no significant association detected between fruit and vegetable servings and BMI (National Institute of Heart, Lung and Blood, 2012). Obesity is associated with numerous comorbidities including diabetes, cardiovascular disease and other chronic conditions that are also risk factors for nonhealing wounds. Additionally, obesity is linked to elevated systemic inflammation, which is a predisposing factor for chronic wounds (National Institute of Health, 2014). Thus the high average BMI of the current study sample suggests that targeted interventions to assist

CVLU patients in achieving healthy weights could potentially facilitate wound healing and improve overall health.

The current study findings that older adults were consuming less than adequate amounts of fruits and vegetables on a daily basis are consistent with several previous studies. This problem has been reported in both chronic wound patients and older adults across the world. For example, a study that assessed fruit and vegetable intake patterns in older adults in South Africa, reported that this segment of the population consumed well below the recommended daily intake levels (Peltzer & Phaswana-Mafuya, 2012). Similarly, a study evaluating fruit and vegetable intake in adults across several regions of the U.S. found that only one in five adults was consuming the minimum recommended daily servings of fruits and vegetables (Serdula et. al., 1995). This finding is consistent with many other studies evaluating fruit and vegetable consumption by U.S. adults (Patterson & Block &Rosenberger & Kahle, 1990 ; Cleveland & Escobar & Lutz & Welsh, 1993). The collective data suggest that future studies of global populations should now focus efforts on identifying the perceived barriers to consuming the recommended daily servings of fruits and vegetables that are known to help prevent comorbidities such as cardiovascular disease, diabetes, and obesity that are also linked to wound healing delays.

Limitations

Limitations of this study include a small sample size consisting of a racially non-diverse group of people, which reduces the generalizability of the findings. Additionally, there were no data collected regarding the sample's perceived barriers to consuming the recommended daily servings of fruits and vegetables that can improve overall health status and prevent certain chronic diseases.

Implications for future practice:

An adequate intake of specific nutrients is extremely important for the wound healing process. Thus a dietary assessment of patients experiencing chronic wounds is an important first step in determining a treatment plan. However, dietary assessments are not currently included as part of standard care for this population. Nutritional counseling based on a dietary assessment could assist patients in reaching a healthy weight, reduce chronic systemic inflammation and reduce the risk of many chronic comorbidities (e.g. diabetes, cardiovascular disease) that are associated with poor health outcomes and delayed wound healing. A multidisciplinary team of doctors, nurses, and dieticians could effectively consider the many factors contributing to the problem of delayed wound healing (such as poor nutrition) and devise a more inclusive plan of care based on the holistic assessment. Nurses play an important role in patient care and are often the most influential patient advocates. Thus, nurses could lead the effort in changing standard care policies for chronic wound patients based on the most current research evidence that a simple dietary change such as increasing fruit and vegetable consumption may improve healing outcomes and the overall health of wound patients.

Recommendations

Additional research is needed to identify the potential barriers to consuming adequate levels of fruits and vegetables on a daily basis in larger, more diverse samples of wound patients. Studies are also needed to determine if supplementing the diets with specific nutrients essential to the wound healing process (e.g. vitamin C, omega-3 fatty acids) could improve the healing time and overall outcomes in patients with CVLUs. Using a standard nutritional assessment tool could assist clinicians in developing more effective plans of care for patients

with chronic wounds and help identify patients who are at risk for poor healing. Additionally, the plans of care should consider patient-identified barriers to eating fruits and vegetables and other nutrient dense foods.

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